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(71) Applicants:  
• **Hitachi, Ltd.**  
**Chiyoda-ku, Tokyo 100-8220 (JP)**  
• **Hitachi Car Engineering Co., Ltd.**  
**Hitachinaka-shi, Ibaraki 312-0062 (JP)**

(72) Inventors:  
• **Nakamaya, Yoko,**  
**c/o Hitachi, Ltd., Int. Prop. Group**  
**Chiyoda ku, Tokyo 100-8220 (JP)**

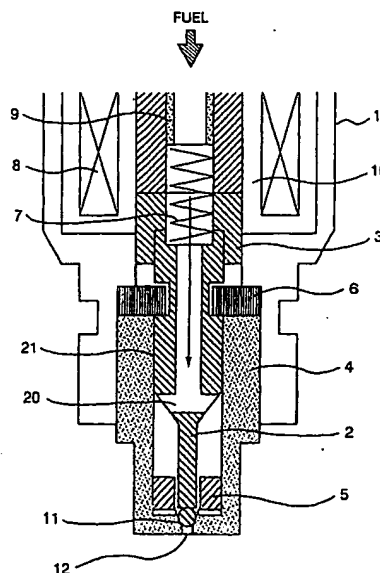
• **Tanabe, Yoshiyuki,**  
**c/o Hitachi, Ltd., Int. Prop. Group**  
**Chiyoda ku, Tokyo 100-8220 (JP)**  
• **Nogi, Toshiharu, c/o Hitachi, Ltd., Int. Prop. Group**  
**Chiyoda ku, Tokyo 100-8220 (JP)**  
• **Kadomukai, Yuzo,**  
**c/o Hitachi, Ltd., Int. Prop. Group**  
**Chiyoda ku, Tokyo 100-8220 (JP)**  
• **Yamakado, Makoto,**  
**c/o Hitachi, Ltd., Int. Prop. Group**  
**Chiyoda ku, Tokyo 100-8220 (JP)**  
• **Sekine, Atsushi, c/o Hitachi Car Eng. Co. Ltd.**  
**Ibaraki-ken 312-0062 (JP)**

(74) Representative: **Beetz & Partner Patentanwälte**  
**Steinsdorfstrasse 10**  
**80538 München (DE)**

(54) **Fuel injection valve**

(57) A damper is formed between the nozzle and the plunger (2) of the fuel injection valve (1). This suppresses the bouncing of the plunger (2) and consequently suppresses secondary injections. Further, this can suppress depositions of chemicals on the fuel injection valve (1), generation of soot at improper combustion of fuel, and combustion control errors.

**FIG. 1**



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# PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention-EP 00 11 3005  
shall be considered, for the purposes of subsequent  
proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 89 10478 A (SIEMENS BENDIX AUTOMOTIVE ELEC) 2 November 1989 (1989-11-02) * the whole document *	2	F02M51/06 F02M61/16
X	US 5 288 025 A (CERNY MARK S) 22 February 1994 (1994-02-22) * the whole document *	2	
X	US 5 271 565 A (CERNY MARK S) 21 December 1993 (1993-12-21) * the whole document *	2	
X	US 5 012 981 A (HOLZGREFE VOLKER ET AL) 7 May 1991 (1991-05-07) * the whole document *	3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F02M
INCOMPLETE SEARCH			
<p>The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPO to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.</p> <p>Claims searched completely :</p> <p>Claims searched incompletely :</p> <p>Claims not searched :</p> <p>Reason for the limitation of the search:</p> <p>see sheet C</p>			
Place of search		Date of completion of the search	Examiner
MUNICH		14 May 2003	Wagner, A
CATEGORY OF CITED DOCUMENTS			
<p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1500 (03.02.92) (P4/C07)



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INCOMPLETE SEARCH  
SHEET C

Application Number  
EP 00 11 3005

Claim(s) searched completely:

2, 3

Claim(s) not searched:

1, 4

Reason for the limitation of the search:

The application does not meet the requirements of Article 84 EPC, because claims 1 and 4 are not clear. An attempt is made to define an apparatus by reference to a result to be achieved.

The solution to the problem of the invention given in the last three lines of claim 1 attempts to define the invention by the result to be achieved, i.e. the underlying technical problem. Claim 1 does not define any technical features which lead unambiguously to the technical effect "so that no fuel may come out through said fuel injection hole after said movable plunger presses against the seat surface".

The solution to the problem of the invention given in the last two lines of claim 4 attempts to define the invention by the result to be achieved, i.e. the underlying technical problem. Claim 4 does not define any technical features which lead unambiguously to the technical effect "wherein the resisting force made when said movable plunger having a valve hits said seat surface is a function of the moving speed of the movable plunger".

The independent claim fail define the invention by all its essential technical features, in order to meet the requirements of Article 84 EPC in the sense of the Guidelines C-III 4.7.

This lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to claims 2 and 3.

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 3005

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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14-05-2003

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 8910478	A	02-11-1989	US	4878650 A	07-11-1989
			DE	68900882 D1	02-04-1992
			EP	0411041 A1	06-02-1991
			JP	2670874 B2	29-10-1997
			JP	3502227 T	23-05-1991
			WO	8910478 A1	02-11-1989
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US 5288025	A	22-02-1994	NONE		
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US 5271565	A	21-12-1993	NONE		
-----					
US 5012981	A	07-05-1991	DE	3624476 A1	28-01-1988
			ES	2004644 A6	16-01-1989
			JP	63029052 A	06-02-1988
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82